Measurement and Calculation

Name: _____ Section: 2AL-___ Date performed: __/__/__

Lab station: _____ Partners: _____

Low-precision method

(Q-1) Measure height and diameter of the cylinder using a meter stick.

$h_{\text{low}} = (\_\_\_\_\_ \pm \_\_\_\_\_)\ \text{cm}$ $d_{\text{low}} = (\_\_\_\_\_ \pm \_\_\_\_\_)\ \text{cm}$

(Q-2) Calculate the cylinder's volume, including uncertainty.

$V_{\text{low}} = (\_\_\_\_\_ \pm \_\_\_\_\_)\ \text{cm}^3$

(Q-3) Measure the mass of the cylinder using a spring scale.

$m_{\text{low}} = (\_\_\_\_\_ \pm \_\_\_\_\_)\ \text{g}$

(Q-4) Calculate the cylinder's density, including uncertainty.

$\rho_{\text{low}} = (\_\_\_\_\_ \pm \_\_\_\_\_)\ \text{g/cm}^3$

High-precision method

(Q-1) Measure height and diameter of the cylinder using micrometer calipers.

$$h_{\text{high}} = (\_\_\_\_\_ \pm \_\_\_\_\_)\,\text{cm} \qquad d_{\text{high}} = (\_\_\_\_\_ \pm \_\_\_\_\_)\,\text{cm}$$

(Q-2) Calculate the cylinder's volume, including uncertainty.

$$V_{\text{high}} = (\_\_\_\_\_ \pm \_\_\_\_\_)\,\text{cm}^3$$

(Q-3) Measure the mass of the cylinder using the electronic balance.

$$m_{\text{high}} = (\_\_\_\_\_ \pm \_\_\_\_\_)\,\text{g}$$

(Q-4) Calculate the cylinder's density, including uncertainty.

$$\rho_{\text{high}} = (\_\_\_\_\_ \pm \_\_\_\_\_)\,\text{g/cm}^3$$

Compare low and high precision

$$\rho_{\text{low}} = (\_\_\_\_\_ \pm \_\_\_\_\_)\,\text{g/cm}^3 \qquad \rho_{\text{high}} = (\_\_\_\_\_ \pm \_\_\_\_\_)\,\text{g/cm}^3$$

$$\text{Discrepancy} = |\rho_{\text{low}} - \rho_{\text{high}}| = \_\_\_\_\_\,\text{g/cm}^3$$

$$\text{Tolerance} = 2(\delta\rho_{\text{low}} + \delta\rho_{\text{high}}) = \_\_\_\_\_\,\text{g/cm}^3$$

Do the values agree? Explain.

Exercises

A measurement which is both precise and accurate:

(A) cannot occur.

(B) is made using an instrument capable of giving a reading with a small uncertainty which has been properly calibrated and is being properly used so as to give correct results.

(C) is made using an instrument capable of giving a reading with a small uncertainty which nevertheless is giving an incorrect result because it is not calibrated properly or is being misused.

(D) is made using an instrument which is not capable of giving a reading with a small uncertainty, but is nevertheless giving correct results (within uncertainty) because it is calibrated correctly and is being properly used.

(E) is made using an instrument which is not capable of giving a reading with a small uncertainty and is also giving an incorrect result because it is not calibrated properly or is being misused.

A measurement which is both precise and inaccurate:

(same choices as above)

A measurement which is both imprecise and accurate:

(same choices as above)

A measurement which is both imprecise and inaccurate:

(same choices as above)

For each of the following numbers, indicate how many significant figures it has and underline the significant figures.

- 5.27
- 527
- 5.270
- 0.00527
- 52700

How would you write "52700" if you wanted to make it clear that it had 4 significant figures?

If you add 712.3 and 5.28, your calculator says 717.58. Which of the following is the correctly rounded result?

(A) 717.58
(B) 717.5
(C) 717.6
(D) 718
(E) 720

Which rule did you use?

If you multiply 712.3 and 5.28, your calculator says 3760.944. Which of the following is the correctly rounded result?

(A) 3760.94
(B) 3760.9
(C) 3761
(D) 3.760×10^3
(E) 3.76×10^3

Which rule did you use?

A cube has a side length $a = (3.7 \pm 0.3)\,\text{cm}$. Its volume (given by a^3) is (show calculation):

(A) $(50.653 \pm 0.027)\,\text{cm}^3$
(B) $(50.7 \pm 0.9)\,\text{cm}^3$
(C) $(50.65 \pm 0.24)\,\text{cm}^3$
(D) $(51 \pm 12)\,\text{cm}^3$
(E) None of the above

Which rules did you use?

You are given $a = 2.16 \pm 0.03$, $b = 1.89 \pm 0.04$, and $c = 0.57 \pm 0.02$. What is $(a - b)/c$ (show calculation)?

(A) 0.4737 ± 0.0002
(B) 0.47 ± 0.03
(C) 0.47 ± 0.07
(D) 0.47 ± 0.09
(E) 0.47 ± 0.14
(F) 0.5 ± 0.3
(G) 0.5 ± 0.5

Which rules did you use?